PB-217 762

WATER RESOURCES STUDY LEE CREEK BASIN ARKANSAS AND OKLAHOMA. STUDY OF POTENTIAL NEEDS AND VALUE OF WATER STORAGE FOR MUNICIPAL, INDUSTRIAL AND QUALITY CONTROL PURPOSES

Public Health Service
Dallas, Texas

August 1964

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WATER RESOURCES STUDY
LEE CREEK BASIN
ARKANSAS AND OKLAHOMA

Study of Potential Needs and Value of Water Storage for Municipal, Industrial, and Quality Control Purposes

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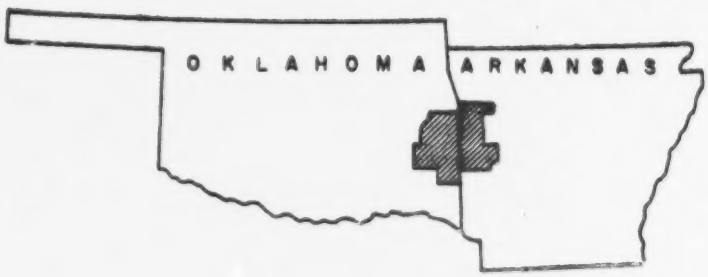

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Public Health Service, Region VII
Dallas, Texas

AUGUST 1964

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WATER RESOURCES STUDY

LEE CREEK BASIN

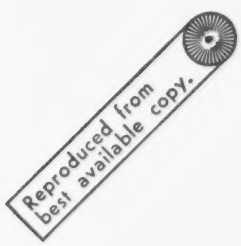
ARKANSAS AND OKLAHOMA

Prepared for

DEPARTMENT OF THE ARMY

U.S. Army Engineer District

Little Rock, Arkansas



U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service, Region VII
Dallas, Texas

AUGUST 1964

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I. INTRODUCTION

Authority

In a letter dated February 20, 1961, the U.S. Army Engineer District, Little Rock, Arkansas, requested that the Public Health Service ". . .make a preliminary investigation of the demand for and value of municipal and industrial water supply on Lee Creek in Western Arkansas and Eastern Oklahoma." Having received the results of this preliminary investigation, the U.S. Army Engineers District further requested a detailed study of the Lee Creek basin.

This study has been made in accordance with (1) the Memorandum of Agreement dated November 4, 1958, between the Department of the Army and the Department of Health, Education, and Welfare, relative to Title III, Public Law 85-500 as amended by Public Law 87-88, and (2) the Federal Water Pollution Control Act (Public Law 84-660) as amended by Public Law 87-88.

Purpose and Scope

This report presents the results of an investigation to determine water requirements for municipal and industrial purposes in the area that could be served by the water resources of Lee Creek. Also investigated was the need for and the value of storage for streamflow regulation for water quality control in the Lee Creek study area. Benefits derived from a Federally constructed reservoir to provide for water needs for a 100-year period have been considered. In this report, two areas will be discussed. The first will be referred to as the "study area" which encompasses seven counties and was selected as a base for projecting economic and demographic parameters. The second area of discussion will be referred to as the "served area" and represents that portion of the "study area" which is expected to meet its water demands from the proposed Lee Creek Reservoir.

Acknowledgments

The cooperation of many people and several agencies was necessary in the development of this study. We are especially grateful to:

Arkansas Water Pollution Control Commission, Little Rock, Arkansas
Arkansas State Board of Health, Little Rock, Arkansas
Arkansas Geological and Conservation Commission, Little Rock, Arkansas
Industrial Research and Extension Center, University of Arkansas, Little Rock, Arkansas

United States Department of Agriculture, Little Rock Arkansas
Fort Smith Chamber of Commerce, Fort Smith, Arkansas
Van Buren Chamber of Commerce, Van Buren, Arkansas
Fort Smith Water Department, Fort Smith, Arkansas
Van Buren Water Department, Van Buren, Arkansas
Pine Mountain Lake Committee, Van Buren, Arkansas

II. SUMMARY AND CONCLUSIONS

Summary

1. The Corps of Engineers is making a study of the Lee Creek River basin to determine the feasibility of constructing a multipurpose reservoir.

2. The study area consists of seven counties in west-central Arkansas and east-central Oklahoma which encompass the Lee Creek River basin. These counties can be characterized economically as the Fort Smith, Arkansas, trade area and include; Scott, Sebastian, and Crawford Counties in Arkansas, and Leflore, Sequoyah, Haskell, and Latimer Counties in Oklahoma.

3. The drainage area of the Lee Creek basin is 450 square miles

4. The population of the study area was 159,266 in 1960, of which 89,847 was urban and 69,419 was rural. County populations were used in the economic section.

5. The principal communities in the study area and their 1960 populations are: Fort Smith, Arkansas - 52,991; Van Buren, Arkansas - 6,787; Poteau, Oklahoma - 4,428; Stigler, Oklahoma - 1,923; Spiro, Oklahoma - 1,862; Waldron, Arkansas - 1,619; Greenwood, Arkansas - 1,558; and Alma, Arkansas - 1,370.

6. Present water demands of the study area are met mainly from surface supplies. Water at the proposed project site on Lee Creek is of exceptional quality, low in mineral salts, and of medium hardness.

7. The Arkansas River flows through the study area. It is highly mineralized and is unfit for municipal water supplies.

Conclusions

1. The population of the area served by Lee Creek is expected to be 240,000 by the year 2025 and 330,000 by 2075. In order to provide water for the municipalities in this area, provisions must be made to supply 48 million gallons per day (mgd) by the year 2025 and 66 mgd by 2075.

2. Resource-oriented industrial development is expected to occur in the study area. That portion of this industry to be served by Lee Creek is expected to require 10 mgd of water in the year 2025, and 15 mgd in the year 2075.

3. The value of benefits attributable to storage for municipal and industrial water supply purposes is estimated to be $322,000 annually. This estimate is based on the cost of the most feasible alternate source of water in absence of the project.

4. The prevailing streamflow of the Arkansas River will provide for the assimilation of adequately treated municipal and industrial waste in the area served by Lee Creek. Therefore, no need for storage for streamflow regulation for water quality control in the Lee Creek study area is foreseen at this time.

5. The proposed Lee Creek reservoir can fulfill the municipal and industrial water requirements of the served area. It could permit a phase-out of the existing facilities at Frog Bayou by the year of first need (1980). It is reported that Frog Bayou operations will become uneconomical because of high costs in operating the old treatment plant and high transmission costs.

III. DESCRIPTION OF THE PROJECT

Location

The site of the proposed Lee Creek (Pine Mountain Reservoir) project is located at river mile 35.8 on Lee Creek approximately 17 miles due north of Fort Smith, Arkansas. (See location map designated figure III-1 in back of this report.) The purpose of the project is to provide flood control, water conservation, and other allied purposes.

The prospective municipal and industrial users of Lee Creek water are grouped in the vicinity of the Arkansas River at the Oklahoma-Arkansas borders and include principally Fort Smith and Van Buren, Arkansas. This region is without a ground water supply in the amount required. Fort Smith, Arkansas, maintains two impoundments on Frog Bayou, approximately 23 miles northeast of the city, which hold water of good quality. These impoundments have an estimated firm yield of 30 mgd and serve as a source of water supply for Fort Smith and intervening areas.

The Arkansas River runs through the Fort Smith-Van Buren area; and although this river is highly mineralized and unsuitable for municipal purposes, it is used to assimilate the waste from the municipalities and industries in the vicinity.

Streamflow

The total drainage area for Lee Creek is approximately 450 square miles. The major tributaries are Little Lee Creek with a drainage area of 114 square miles, and Cove Creek with a drainage area of 52 square miles. Flow data for Lee Creek are rather scarce, but available data indicate an average mean yearly flow of approximately 500 cubic feet per second (320 million gallons daily). 1 2/

Quality

The water in Lee Creek is of exceptional quality. All available analysis reveal that the major chemical constituents are below the Public Health Service Drinking Water Standards. Table III-1 illustrates the chemical analysis of the Lee Creek waters.

Table III-1

Chemical Analysis
Lee Creek, Arkansas
(mg/l)

Date	Chlorides	Nitrates	Hardness Ca-Mg	Dissolved Solids
10- 1-54	6.8	0.8	46	69
10-30-54	3.0	3.0	37	85
11- 8-54	6.5	2.1	37	62
12-10-54	15.0	0.5	41	79
1 -13-55	3.5	3.4	28	54
2 - 9-55	3.5	1.5	28	62
3 -15-55	3.5	1.4	31	60
4 - 6-55	3.0	0.4	28	59
6 -15-55	3.2	1.0	20	54
9 -28-55	4.2	0.3	37	55
10-26-55	3.5	0.4	30	50
11-29-55	4.5	0.4	39	44
2 -20-56	8.6	0.8	33	61
5 -15-56	4.5	0.4	35	38

Source: Geological Survey 3/

IV. CHARACTERISTICS OF THE STUDY AREA

The study area consists of Crawford, Sebastian, and Scott Counties, Arkansas, and Sequoyah, Haskell, Latimer, and LeFlore Counties, Oklahoma. These counties logically belong in the Fort Smith, Arkansas, trade area and, as such, will share in the benefits derived from any water resource development in the area.

The study area is characterized by forested mountains and fertile valleys. Approximately two-thirds of the study area is forested. Nonforested land area is generally in pasture with approximately 6 percent of the total land area in crop production. 4/

The area is favored by a mild climate. Rainfall is above adequate, ranging from 50 inches per year in the southern region to 40 inches per year in the northern region. 5/

Average annual precipitation runoff ranges from 10 to 20 inches per year. 5/ Most of the area's water needs are met by surface supplies. Ground water is scarce in the study area and may be considered of little consequence for present or future needs.

Fort Smith, Arkansas, is the hub of economic activity in the study area. It has grown from a population of 31,000 in 1930 to approximately 63,000* in 1962. Extending outward from Fort Smith are smaller municipalities whose growth rates are small to declining. Poteau, Heavener, Wilburton, Talihina, Spiro, Panama, and Arkoma, Oklahoma, are the towns most likely to play a role in the study area's economy, as are Van Buren, Waldron, Greenwood, and Alma, Arkansas. Wood and wood products and food and kindred products are the principal manufacturing activities in the study area.

*Special Census, Bureau of the Census, June 1962.

V. THE ECONOMY

Past and Present

Labor Force and Population

Table V-1 illustrates the employment picture of the study area in 1940, 1950, and 1960.

Table V-1

Study Area Labor Force and Population
1940 - 1960

	1940		1950		1960	
	Number	Percent	Number	Percent	Number	Percent
Agriculture, Forestry, Fisheries	18,450	28.53	13.141	23.79	4,178	8.02
Mining	1,091	1.69	1,654	2.99	811	1.56
Manufacturing	6,975	10.79	8,607	15.58	10,896	20.93
Resource Oriented	5,993	9.27	7,300	13.21	8,613	16.54
Nonresource Oriented	982	1.52	1,307	2.37	2,284	4.39
Basic Industries	26,516	41.01	23,402	42.36	15,886	30.52
Service Industries	25,748	39.88	28,584	51.73	31,746	60.98
Unemployed	12,354	19.11	3,267	5.91	4,426	8.50
Total Labor Force	64,654	100.00	55,253	100.00	52,058	100.00
Total Population	198,737	----	175,038	----	159,226	----
Labor Force % of Population	----	32.5	----	31.60	----	32.70

Source: Bureau of the Census 6/

As shown in table V-1, the study area total population decreased 20 percent from 1940 to 1960. Oklahoma experienced no population change during this period while Arkansas experienced an 8 percent decrease.

The labor force in the study area is shifting from agriculture to manufacturing and service industries. In 1960, the agricultural labor force was only 23 percent of the 1940 agricultural labor force. During this same period, manufacturing employment has increased 56 percent and service industry employment has increased 43 percent. This shift to manufacturing and service industry came while the study area labor force was decreasing by 20 percent.

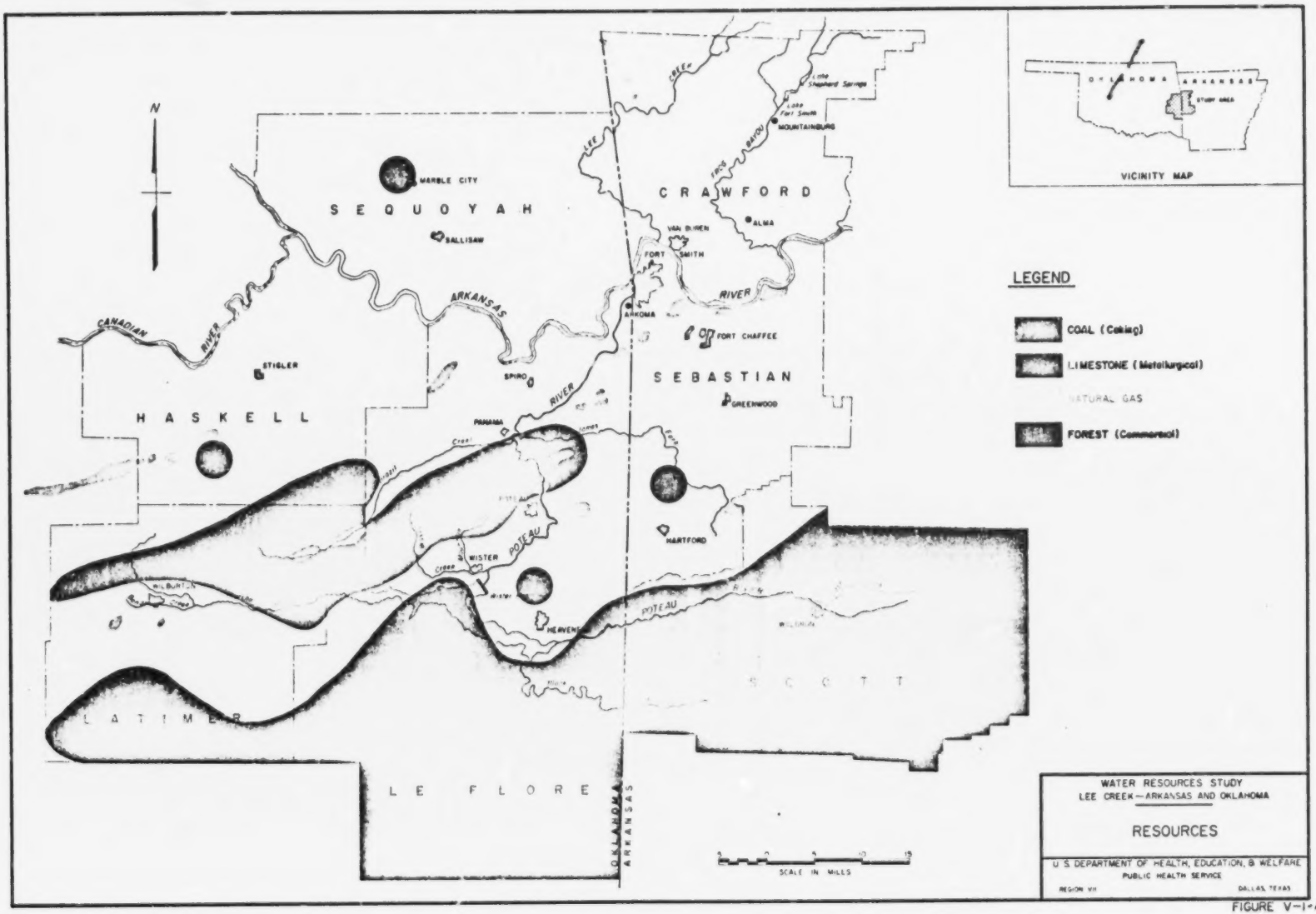

N
MARBLE CITY
SEQUOYAH
SALLISAW
CRAWFORD
MOUNTAINBURG
ALMA
VAN BUREN
FORT SMITH
ARKOMA
FORT CHAFFEE
SEBASTIAN
GREENWOOD
CANADIAN RIVER
ARKANSAS RIVER
STIGLER
SPIRO
HASKELL
PANAMA
HARTFORD
WISTER
POTEAU
HEAVENER
LATIMER
LE FLORE
SCOTT
OKLAHOMA
ARKANSAS
SCALE IN MILES
VICINITY MAP
LEGEND
COAL (Coking)
LIMESTONE (Metallurgical)
NATURAL GAS
FOREST (Commercial)
WATER RESOURCES STUDY
LEE CREEK — ARKANSAS AND OKLAHOMA
RESOURCES
U. S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VII
DALLAS, TEXAS

FIGURE V-1-A

Manufacturing

Manufacturing employment increased from 15 percent of the labor force in 1950 to 21 percent of the labor force in 1960. Table V-2 reveals that since 1939 the area has experienced a continued growth of new establishments and substantial expenditures of new capital. Food and kindred products, lumber, and wood products are the major manufacturing activities in the study area.

Table V-2

Manufacturing Activity in the Study Area
1939 - 1958

Year	Number of Establishments	Value Added*
1939	128	21,200
1947	177	34,500
1954	205	49,000
1958	244	60,500

*All values in 1,000's of 1960 dollars.

Source: Bureau of the Census. 7/

Agriculture

Table V-3 illustrates the agricultural history of the study area. These statistics are significant in that they show a decline in the number of farms and croplands accompanied by a substantial increase in the value of farm products.

Table V-3

Agricultural Statistics for the Study Area
1944 - 1959

	1944	1949	1954	1959
Number of Farms	15,178	13,325	10,953	8,304
Acres of Cropland Harvested	361,930	265,840	221,100	193,860
Value of all Crops Sold*	6,050	4,800	3,770	5,500
Value of all Livestock and Livestock Products Sold*	7,400	7,900	8,800	17,100
Total Value of all Farm Products Sold*	13,450	12,700	12,570	22,600

*All values in 1,000's of 1960 dollars.

Source: Bureau of the Census 8/

Improved farm technology has resulted in the elimination of marginal farm owners who have given way to larger more efficient operators. This improved farm technology has accounted for both the increased production illustrated in table V-3 and the drop in farm labor already cited in table V-1. Table V-3 also indicates a conversion of some croplands to pasture with an accompanying increase in livestock activity.

Forestry

Approximately two-thirds of the study area is in forest, consisting of 55 percent softwoods and 45 percent hardwoods. The Ouachita and Ozark National Forest account for about one-quarter of these forested areas. 9/ Also included in these forest areas are about 2,300,000 acres of forest considered to be of commercial quality. The sustained yields from these commercial forests are estimated to be about 143 million board feet per year of softwood, and 43 million board feet per year of hardwood. 10/

Forestry and wood-using industries employ approximately 8.5 percent of the labor force in the study area. The area has not realized the timber economy available because (1) principal wood-using industries now in the study area are lumber and furniture which place exacting requirements on the quality of timber used, and hence, a large portion of the forest resources are unusable, and (2) the pulp and paper industry, which could provide a market for almost all types of timber, has not established in the study area.

Mining

The value of minerals extracted from the study area from 1953 through 1960 is given in table V-4.

Table V-4

Value of Mineral Production in the Study Area
1953 - 1960

Year	Value*	Year	Value*
1953	12,400	1957	13,900
1954	9,450	1958	13,400
1955	12,300	1959	10,800
1956	13,200	1960	10,750

*All values in 1,000's of 1960 dollars.

Source: Bureau of Mines 11/

Both the Arkansas and Oklahoma counties of the study area account for about 1 percent of their respective State's minerals production. Coal, natural gas, sand, gravel, and limestone represent the bulk of the minerals extracted from the study area.

Despite this mineral production activity, there remains within the study area a vast stockpile of raw materials that have the potential of bringing industrial growth to the region. These resources have not played a prominent role in the area's economy in recent years but cannot be ignored in considering the future of the basin. The following resources are shown on the resources map designated figure V-1:

Coal

Much of the known coal reserves of Arkansas and Oklahoma are located in the study area. The magnitude of minable coal reserves is difficult to define, but most authorities indicate a reserve above one billion tons. 12,13/ In the past, mining operations have been limited to the coal that is readily accessible and even these mining operations have been abandoned in recent times.

The principal reasons for dormant coal mining activity are (1) unfavorable proximity to market and high transportation cost, and (2) because the coal is situated in narrow, steep veins, the ratio of market price to production cost is low.

Natural Gas and Natural Gas Liquids

The reserves of natural gas and natural gas liquids are one of the major assets of the study area. They represent a source of raw materials for petrochemical manufacture as well as a source of fuel. 14/ Geologists have named this area of petroleum reserves the Arkoma basin. The Arkoma basin has been used as a minor supply of natural gas for local consumption for over fifty years and some of the original wells still produce. Several wells have been drilled in the Arkoma basin that produced over thirty million cubic feet of gas per day and have been "shut in" for lack of demand. 15/ Large reserves of not only natural gas but natural gas liquids, petroleum oil, and asphalt are available in the basin awaiting only exploitation. The lack of a market outlet has restricted further exploration in the Arkoma basin.

Limestone

There are numerous supplies of limestone in the United States, and generally most of these limestone deposits do not represent a real asset to the region in which they are located. High quality deposits suitable as chemical grade limestone are not plentiful in most areas, but such high quality reserves do exist in the study area and are presently being mined by a company near Marble City in Sequoyah

County, Oklahoma. This company reports it has 36 million tons of limestone analyzing 98.5 percent calcium carbonate, and 1.5 percent magnesium carbonate, and 90 million tons at 97 percent calcium carbonate. 16/ These reserves could support a sizable mining operation for 100 years. In addition to these known reserves, other parts of this same formation are untapped.

Future

An examination of the study area's history by itself could lead to a prediction of slow economic growth for the area. Extrapolation of most economic data would suggest a growth rate below national averages. In the case of the study area, the potentialities are of more significance than its history. Development of water resources of the area cannot be looked upon as preparing for inevitable economic prosperity. In this case, economic prosperity will be a result of water development. Economic growth in the area can only be spectacular when the total water resources are fully developed. All of the resources in the study area support industry which measures its raw materials and products in tons or gallons. For these industries, water transportation is a prine asset. In some cases, it is an essential part of their operations.

Navigation of the Arkansas River can provide an impetus for development of the area's resources. Barge navigation could trigger a resumption of idled coal mining activities. Other factors in favor of future coal development are:

1. Natural gas, which replaced coal as a source of fuel in many applications, is increasing in price. Continued price increases will result in coal once again being competitive.

2. Improved technology in coal operations is permitting the mining of narrow, steep veins of coal (a characteristic of the study area coalfields) that were previously uneconomical to mine.

3. A steel mill located in the study area, using local coking coal and metallurgical grade limestone would be feasible after navigation. All of the raw steel consumed in Arkansas and Oklahoma is imported from distant states.

Fifty to 100 years in the future, atomic energy can be expected to capture a large portion of the fuels market from coal and natural gas. But while caution must be used in projecting coal demands as a source of fuel, a more liberal view is held regarding coal for coking purposes.

Two noteworthy studies have recently been made which have substantiated that a steel mill will be feasible in the Eufaula-Poteau

area of the Arkansas River after the advent of navigation. These studies, one an unpublished report by the Bureau of Business Research at the University of Oklahoma, and a published report by Tec-Search, Inc. of Evanston, Illinois, entitled "The Central Oklahoma Waterway: Feasibility and Economic Benefits," state that Oklahoma and its six surrounding states are presently a market for 9.4 million tons of steel annually and will demand 30 million tons of steel by the year 2025. 16/ Obviously no one steel mill in the area will capture this entire market. The data clearly represent the size of the market in which such a steel mill will be in a position to compete.

This market plus proven reserves of coking coal and metallurgical grade limestone, further enhanced by fully developed water resources are factors which will make it feasible for iron ore from northeast Texas, the Pea Ridge area of Missouri, or even South America to move by barge to the study area for processing. There seems to be no question but that a steel mill will be built in the study area; the only question is when. Tec-Search discussions with leading steel producers clearly indicate that the opening of the canal in 1975 is the logical starting date.

Figure V-2 illustrates a possible industrial complex for the study area which could be realized by the year 2025. The color key for the industrial complex chart corresponds to the color key used in the resources map (figure V-1). The guidelines used in the design of the complex were as follows: The kinds of industries are based on the resources of the area and satellite industries that thrive on the by-products of the principal resource-oriented industries.

The size of the steel mill was set at one million tons per year of finished steel. This figure is somewhat arbitrary, but represents a conclusion based on reasonable economic size and on the market for steel that the study area mill might serve. 16/ Coke requirements of the steel mill determined the size of the coking plant. 17/

By-product benzene from the coking plant was utilized as a raw material in sizing the petrochemical plant. Other factors considered in sizing the petrochemical plant were feasible yields of natural gas and natural gas liquids in the area. A natural gas plant was designed to supply the requirements of the industries in the area.

Steel mill slag and fly ash are a desirable raw material for cement manufacture, and these by-products in addition to local limestone became the basis for design of a cement plant in the area.

A kraft pulp plant completed the industrial complex for the area. The kraft plant bears no real relationship to the rest of the complex, but sustaining yields of timber, high quality limestone, and developed water resources, together with a market for the paper, were factors which necessitated its inclusion as a new industry.

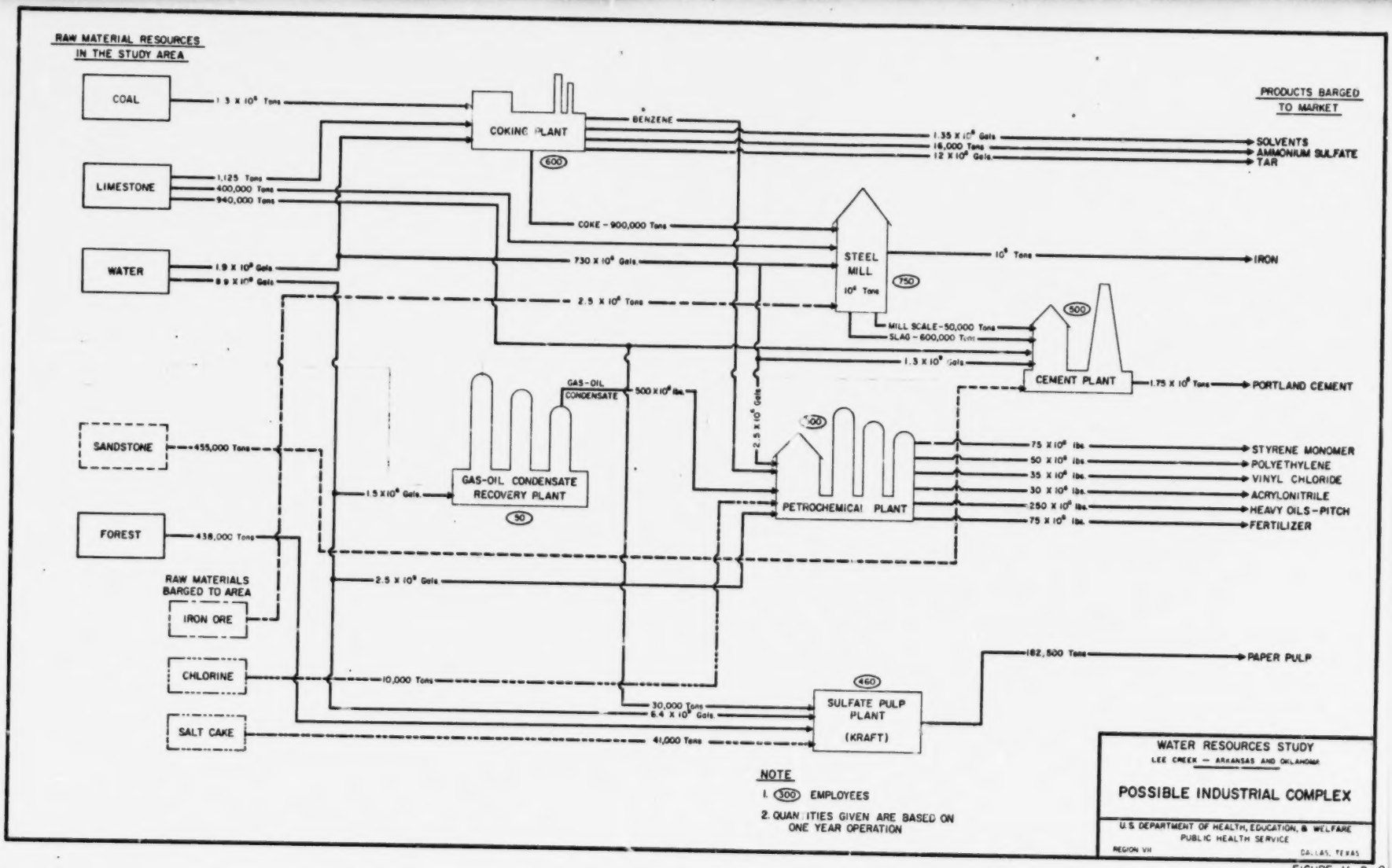

RAW MATERIAL RESOURCES IN THE STUDY AREA
COAL
1.3 X 10⁶ Tons
LIMESTONE
1,125 Tons
400,000 Tons
940,000 Tons
WATER
1.9 X 10⁹ Gals
8.9 X 10⁹ Gals
SANDSTONE
455,000 Tons
FOREST
438,000 Tons
RAW MATERIALS BARGED TO AREA
IRON ORE
CHLORINE
SALT CAKE
COKING PLANT
600
BENZENE
COKE - 900,000 Tons
730 X 10⁶ Gals
2.5 X 10⁶ Tons
1.5 X 10⁶ Gals
GAS-OIL CONDENSATE RECOVERY PLANT
50
GAS-OIL CONDENSATE
500 X 10⁶ lbs.
2.5 X 10⁶ Gals
10,000 Tons
30,000 Tons
6.4 X 10⁶ Gals
41,000 Tons
STEEL MILL
10⁶ Tons
750
MILL SCALE - 50,000 Tons
SLAG - 600,000 Tons
1.3 X 10⁶ Gals
CEMENT PLANT
500
PETROCHEMICAL PLANT
100
SULFATE PULP PLANT (KRAFT)
460
PRODUCTS BARGED TO MARKET
1.35 X 10⁶ Gals
16,000 Tons
12 X 10⁶ Gals
SOLVENTS
AMMONIUM SULFATE
TAR
10⁶ Tons
IRON
1.75 X 10⁶ Tons
PORTLAND CEMENT
75 X 10⁶ lbs.
50 X 10⁶ lbs.
35 X 10⁶ lbs.
30 X 10⁶ lbs.
250 X 10⁶ lbs.
75 X 10⁶ lbs.
STYRENE MONOMER
POLYETHYLENE
VINYL CHLORIDE
ACRYLONITRILE
HEAVY OILS-PITCH
FERTILIZER
182,500 Tons
PAPER PULP
NOTE
1. (300) EMPLOYEES
2. QUANTITIES GIVEN ARE BASED ON ONE YEAR OPERATION
WATER RESOURCES STUDY
LEE CREEK — ARKANSAS AND OKLAHOMA
POSSIBLE INDUSTRIAL COMPLEX
U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VII
DALLAS, TEXAS

FIGURE V-2-A

Population Projections

Population projections for the study area are based on the following parameters:

1. New employment in the area made possible by resource-based manufacturing.

2. New employment in the area made possible by location of satellite industries.

3. Increased employment resulting from the growth of supporting and service industries.

4. Current trends in employment in fields not directly affected by industrial growth such as agricultural and forestry.

Table V-5 illustrates employment for 1960 and that expected in the year 2025.

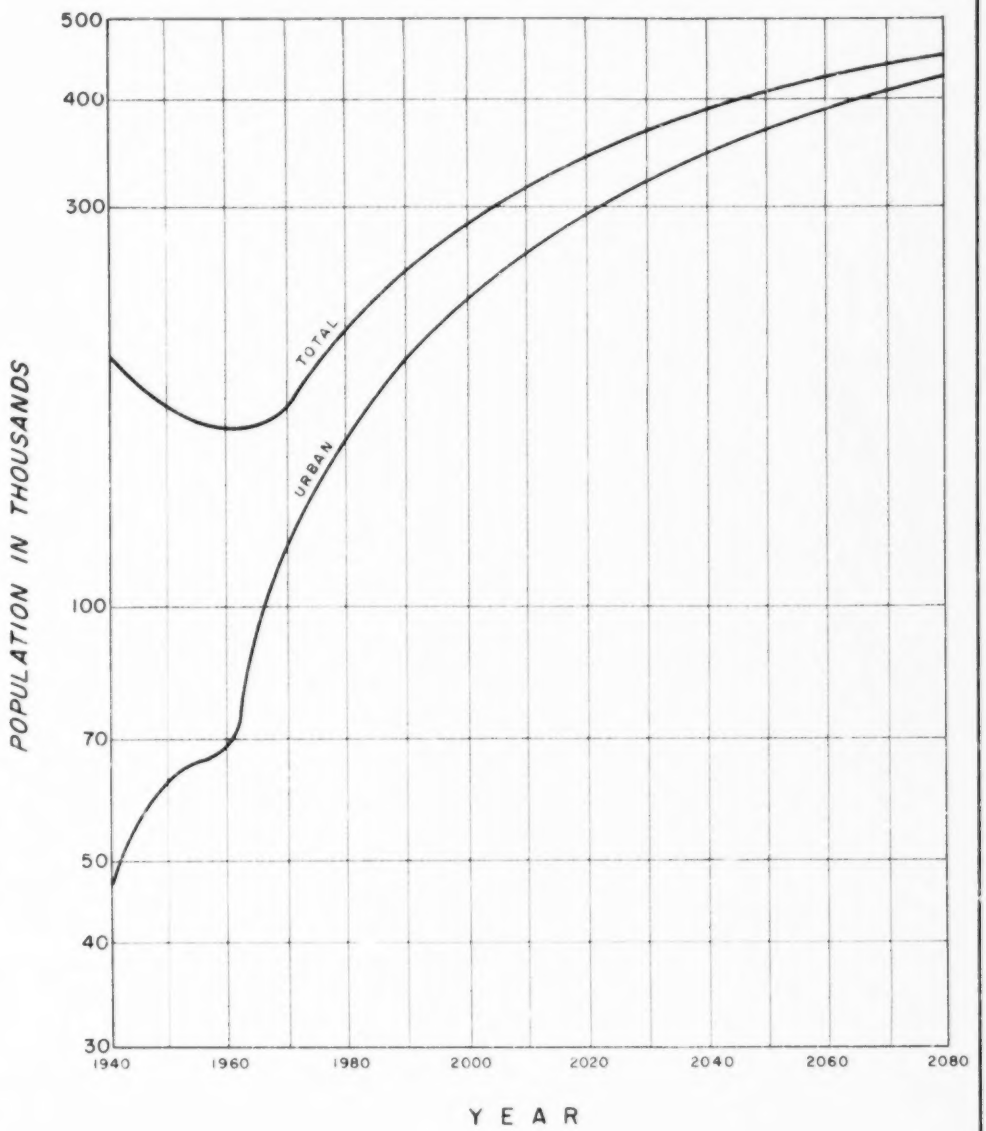
Table V-5

Study Area Labor Force and Population
1960 - 2025

	1960		2025	
	Number	Percent	Number	Percent
Agriculture, Forestry, Fisheries	4,178	8.02	3,500	2.34
Mining	811	1.56	7,500	5.01
Manufacturing	10,897	20.93	43,000	28.73
Resource Oriented	8,613	16.54	33,000	22.04
Nonresource Oriented	2,284	4.39	10,000	6.69
Basic Industries	15,886	30.52	54,000	36.07
Service Industries	31,746	60.98	89,715	59.93
Unemployed	4,426	8.50	5,988	4.00
Total Labor Force	52,058	100.00	149,700	100.00
Total Population	159,226	--	365,000	--
Labor Force % of Population	--	32.7	--	41.00

Source: Bureau of the Census 18/

Figure V-3 illustrates population projections for the study area. The total population is expected to increase from 200,000 (1960 census) to 365,000 by 2025. Extrapolation past the year 2025 gives an estimated study area population of 450,000 by 2075. The urban population is shown to reach 330,000 by 2025 and 440,000 by 2075.



WATER RESOURCES STUDY
LEE CREEK — ARKANSAS AND OKLAHOMA

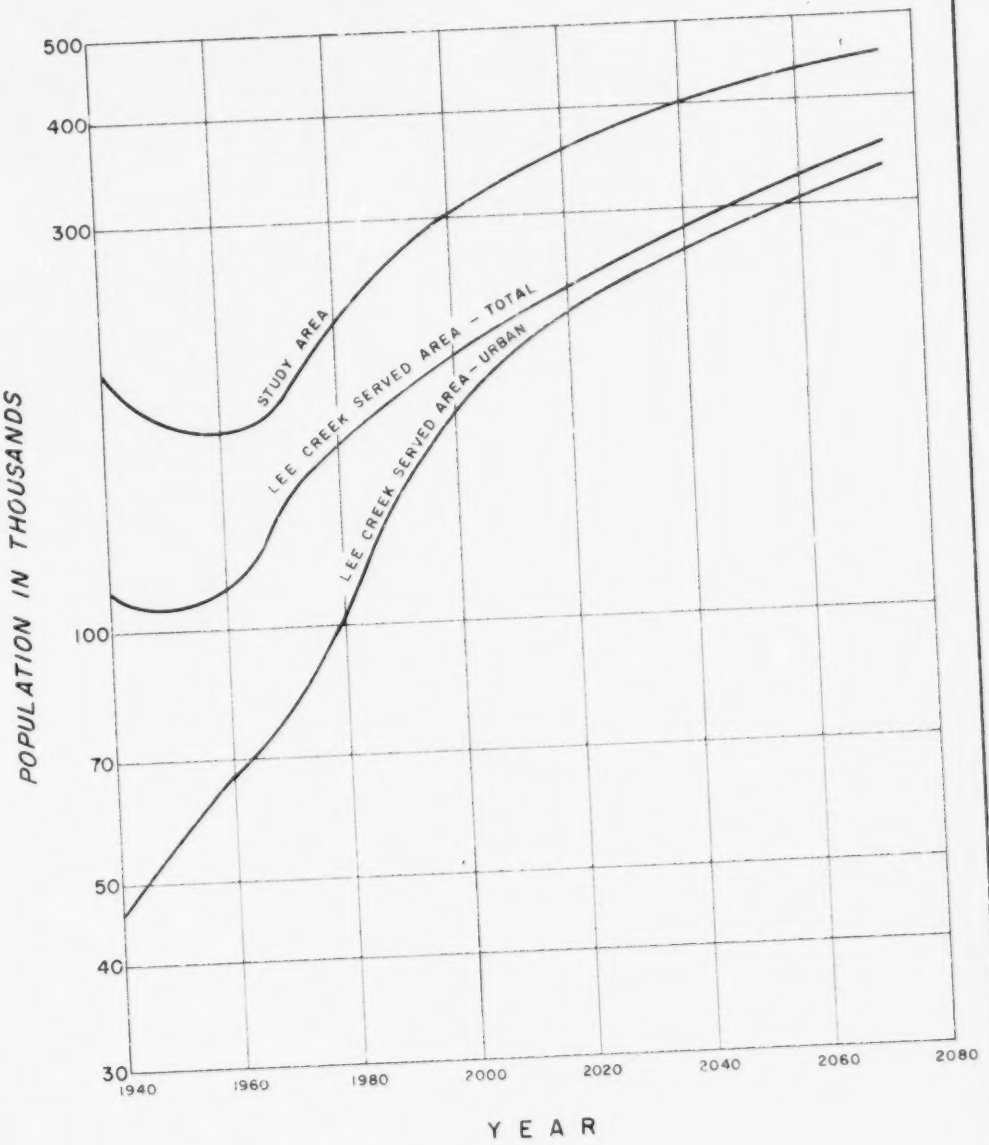
POPULATION PROJECTIONS
STUDY AREA

U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VII DALLAS, TEXAS

FIGURE V-3-A

Not all of the study area will be served by the water resources of Lee Creek. There are essentially two water-served areas within the study area. Poteau, Heavener, Wilburton, Oklahoma, and Waldron, Arkansas, are expected to be served by the water resources of the Poteau River. The expected municipal and industrial water requirements for the Poteau River basin were subtracted from the total study area requirements in order to arrive at the demands to be supplied by Lee Creek. Fort Smith and Van Buren, Arkansas, and Arkoma, Oklahoma, are the principal water-using municipalities of the Lee Creek area and these cities represent the larger portion of the population of the study area.

Figure V-4 shows population projections for that portion of the study area which will be served by water from Lee Creek. The served area had a total 1960 population of 115,000. This population is expected to reach 260,000 by the year 2025 and 350,000 by the year 2075. The corresponding urban population is expected to reach 240,000 by the year 2025 and 330,000 by 2075.



WATER RESOURCES STUDY
LEE CREEK — ARKANSAS AND OKLAHOMA

POPULATION PROJECTIONS
SERVICE AREA

U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VII DALLAS, TEXAS

FIGURE V-4-A

VI. WATER REQUIREMENTS

Municipal

Municipal water requirements are based on a per capita use which is expected to be 200 gallons per capita day (gpcd) by the year 2025. It has been assumed that this same per capita consumption will prevail in 2075. This includes not only water for personal and home use, but water used by service and light industries, and distribution and treatment plant losses. Municipal water use was obtained by multiplying per capita water use by the population that will be served in the years 2025 and 2075. This gives an expected municipal water demand of the Lee Creek served area of 48 mgd in 2025 and 66 mgd by 2075.

Industrial

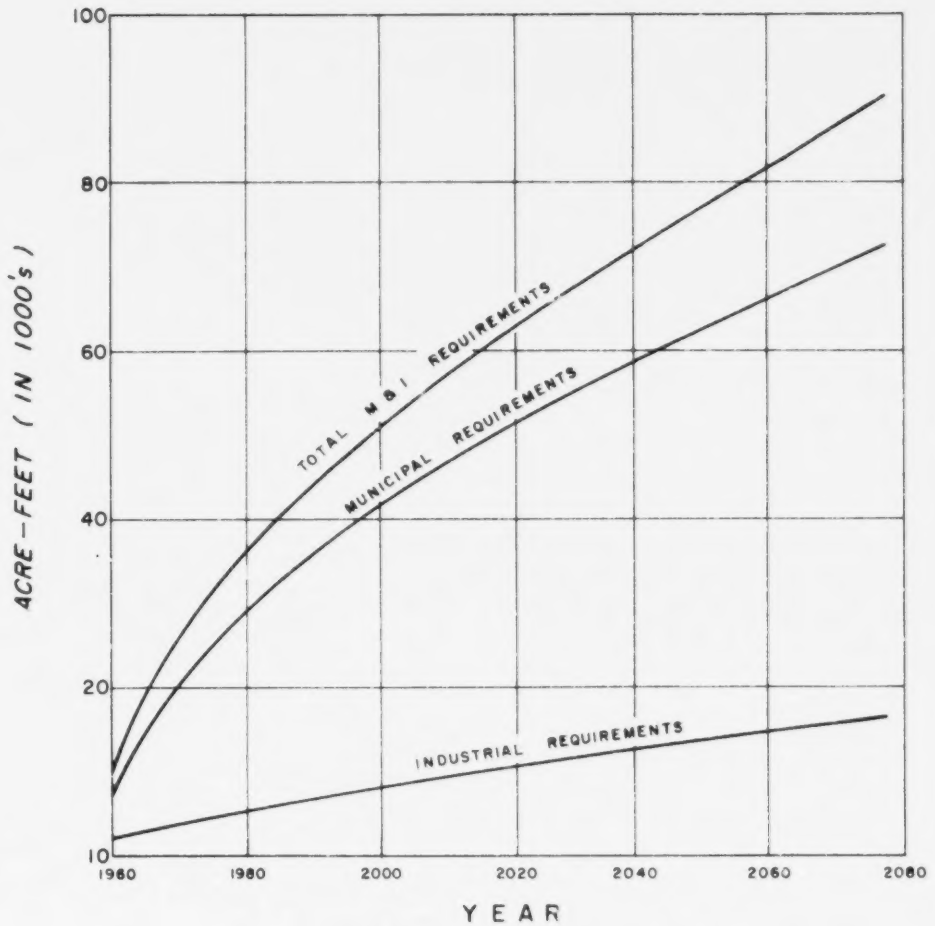
Industrial water demands are those to be used by manufacturing and thermoelectric power industries in the area. It is assumed that this water will be taken directly from the reservoir or stream and treated inside the user's plant. Industrial water use figures are based on units of output. 17 19/ Data concerning present water use per unit of output were adjusted downward in some cases where it is known that air-cooling is replacing water-cooling, and in other cases where it is apparent that water consumption per unit of product is declining due to more efficient processes. Heavy water-using industries will rely on Arkansas River water for their supply. Although this water will be of lesser quality than Lee Creek water, it will still be usable for a large percentage of the industrial users because of its abundance and convenience.

Certain users of water for industrial purposes will require a higher quality of water than the Arkansas and will be users of Lee Creek resources. In this category are the food and kindred industries. Also, smaller industries will be users of Lee Creek water because their water usage is not high enough to justify separate treating facilities for Arkansas River water.

A part of the expected industry locating in the study area will secure their water from the Poteau River basin, and consequently, will not be users of water from the Lee Creek Reservoir.

That portion of the industrial water demands to be met from the Lee Creek project is expected to be 10 mgd by the year 2025 and 15 mgd by the year 2075.

Municipal and industrial water requirements through the year 2075 are illustrated in figure VI-1.



WATER RESOURCES STUDY
LEE CREEK — ARKANSAS AND OKLAHOMA

WATER REQUIREMENTS
SERVICE AREA

U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VII DALLAS, TEXAS

FIGURE VI-1-A

VII. WATER QUALITY CONTROL

A major factor in providing adequate water resources for any sector of the country is the problem of waste disposal. Thorough water planning for an area must include not only adequate water supplies for municipal and industrial users but must also insure that adequate assimilative flows exist in the streams which receive the treated waste of the area. Congress emphasized the importance of water quality control as it applies to our Nation's water resources by the enactment of the Federal Water Pollution Control Act, Public Law 84-660, as amended by Public Law 87-88. Under the provisions of this act, consideration must be given to the inclusion of storage for regulation of streamflow to control water quality in any reservoir being planned by a Federal agency. Storage and release of this water are not to be provided as a substitute for adequate treatment of wastes at the source.

The principal water users in the Lee Creek served area are Fort Smith and Van Buren, Arkansas. Consequently, the waste from these two cities is the primary concern in water quality control.

Fort Smith and Van Buren are situated on the bank of the Arkansas River. The Arkansas River, although highly mineralized, has the assimilative capacity to handle a significant quantity of municipal and industrial waste. Historically, the river has been used for the disposal of waste from both Fort Smith and Van Buren. At the present time, both cities are in the process of providing waste-treating facilities.

The Lee Creek, on the other hand, is without any sources of waste from either municipalities or industries. It is not expected that any significant amount of industrial or municipal growth will occur along this stream in the future. For this reason, there is no foreseeable need for dilution water for quality control on Lee Creek.

Water quality control calculations for the Arkansas River were based on the municipal and industrial projections for the year 2075. Using these projections, the amounts and quality of return flows were estimated. Based on these estimates, a dry stream dilution water requirement of 420 cfs will be required in the Arkansas River.

Based on a monthly analysis of water quality control needs, it was found that the average flow of the Arkansas River was 13 times greater than the minimum quality requirements even at the 98 percent exceedence interval.

It is realized that the Arkansas River will undergo many changes by the year 2075. Proposed projects aimed at flood control, water supply, hydroelectric power, and navigation will alter the flows in the Arkansas River from what they have been in the past. However, calculations by the Corps of Engineers show that these projects will result in more dilution water being available and at a more uniform level than is now experienced in the Fort Smith-Van Buren area.

Because it is not probable that a significant industrial or municipal growth will take place along the Lee Creek, and because the Arkansas River will have more than adequate assimilative capacity to handle the expected treated municipal and industrial waste imposed upon it, there is no need for storage for quality control in the proposed Lee Creek project.

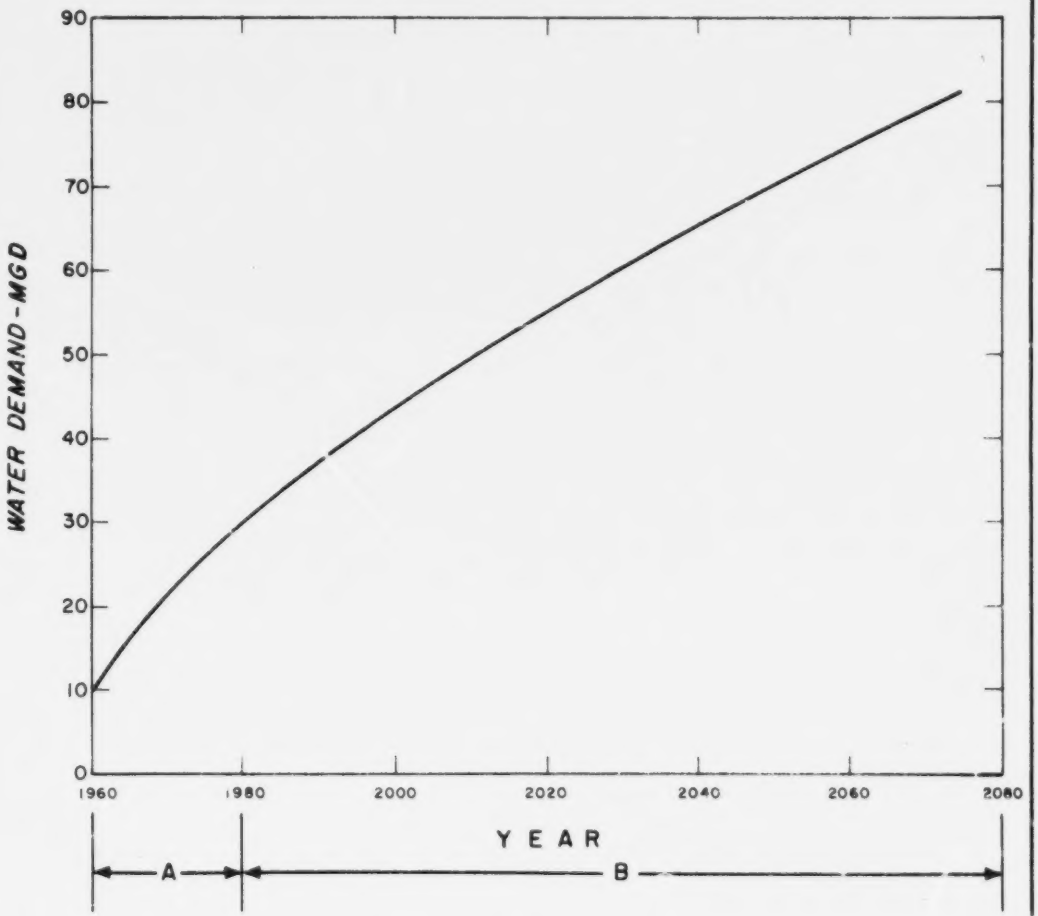
VIII. WATER PLAN

A water plan for the area served by Lee Creek involves a utilization of the existing supplies of Frog Bayou until the year 1980. At this time the proposed Lee Creek project will allow a phase-out of the old facilities and a utilization of the proposed project to supply all of the expected municipal and industrial needs of the area.

In order to meet the 1980 demands of the served area, the two existing impoundments on Frog Bayou must be utilized to the full extent of their 30 mgd dependable yields. In order to utilize this 30 mgd, revisions will have to be made to the present transmission facilities. These revisions will involve enlarging pumping equipment and transmission lines.

By the year 1980, the water requirements of the served area will begin to exceed the capacity of existing sources, and the proposed impoundment on Lee Creek will be needed. Water from the proposed impoundment could reach a new treatment plant in the vicinity of the Lee Creek-Arkansas River confluence via channel transmission. It is reported that Frog Bayou operations will become uneconomical because of the high cost of operation at the old treatment plant and high transmission costs. At this time a phase-out of these facilities is expected with new facilities supplying all of the expected municipal and industrial water requirements for Fort Smith and intervening areas.

Figure VIII-1 illustrates the timing and water demands for the Lee Creek water plan through 2075.



A. THIS DEMAND MET BY EXISTING SOURCES ON FROG BAYOU AND REVISED TRANSMISSION FACILITIES.

B. THIS DEMAND MET BY THE PROPOSED LEE CREEK PROJECT (PINE MOUNTAIN RESERVOIR WITH CHANNEL TRANSMISSION TO FT SMITH) — FROG BAYOU PHASED OUT.

WATER RESOURCES STUDY
LEE CREEK — ARKANSAS AND OKLAHOMA

SERVED AREA WATER PLAN

U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VII DALLAS, TEXAS

FIGURE VIII - 1 - A

IX. BENEFITS

The following presents the benefits analysis for the proposed Lee Creek project. The benefit analysis is given in three parts. Part one discusses the various assets made possible by the proposed project; part two presents several possible alternatives to the proposed project; and part three approximates the value of the project benefits by the cost of the most feasible alternative.

General Benefits

The proposed Lee Creek project will result in the following advantages to the area it serves:

1. The proposed impoundment can supply the estimated municipal water requirements of the area through the year 2075. It will eliminate the need for other water supply sources and allow a centralization of treating and pumping facilities. The Pine Mountain Reservoir will allow channel transmission of the water to Fort Smith, and thus eliminate the high pipeline transmission cost associated with the Frog Bayou sources.

2. The project represents an assurance to existing and prospective industry that ample reserves of high-quality water are provided for their needs. Navigation of the Arkansas River could attract new resource-based industry to the area, and the assurance of adequate water supplies will be an added enticement that could result in substantial economic growth for the Fort Smith vicinity. Failure to provide adequate water reserves could cancel the advantages of navigation.

3. Because the watershed for the proposed reservoir is free of natural and manmade pollutants, the quality of the impounded water will be good, and variations in taste, odor, solids, and hardness will be at a minimum. The chances for serious contamination of water in the proposed reservoir are remote. These factors provide low treatment cost for both municipal and industrial users and provide a uniform, high quality water at the consumer's faucet. High quality water of the Lee Creek impoundment will be especially conducive to further expansions of food and kindred industries in the Fort Smith-Van Buren area, since this industrial user relies heavily on high quality water.

Alternatives

Senate Document No. 97 (87th Congress, 2d sess.) permits the following method of measuring benefits of storage in Federal reservoirs for municipal and industrial water supply purposes:

> "The amount water users should be willing to pay for such improvements in lieu of foregoing them affords an appropriate measure of this value. In practice, however, the measure of the benefit will be approximated by the cost of achieving the same results by the most likely alternative means that would be utilized in the absence of the project."

In order to determine the most likely source of water in absence of the project, all alternates were investigated. The following summarizes the alternative investigation:

1. Use Arkansas River Water. This alternate to the project was rejected because the water is highly mineralized. Although projects are planned to improve the quality of the Arkansas River water, the degree of success and timing are too uncertain to warrant consideration to its being available as a water supply source by the year of first need (1980).

2. Use Ground Water. This alternate was rejected as the likely source of water in absence of the project because it is highly unlikely that sufficient reserves of ground water exist for future requirements. Studies of ground water in the vicinity of Fort Smith describe the wells as poor to moderate yielders. Any wells in the area along the Arkansas River stand the danger of being flow-induced by the Arkansas, and this would result in poor quality water.

3. Use the existing sources of Frog Bayou (30 mgd) and supplement this with a 51 mgd single-purpose reservoir at the Hackett damsite on the James Fork River. Use channel transmission to transfer the water to Fort Smith. This alternate was rejected because it is more expensive than alternate 5. (See table IX-1.)

4. Use the existing sources of Frog Bayou (30 mgd) and supplement with a 51 mgd single-purpose reservoir at the Pine Mountain damsite on Lee Creek. Use channel transmission to transfer the water to Fort Smith. This alternate was rejected because it is more expensive than alternate 5. (See table IX-1.)

5. Use an 81 mgd single-purpose reservoir constructed at the Pine Mountain damsite on Lee Creek. This alternate was selected as the most feasible water supply in absence of the proposed project because it represents the least costly alternative. The cost of this alternate (See table IX-1) is the estimated value of benefits derived from construction of the proposed Lee Creek Reservoir.

Worth of Annual Benefit Sample Calculation

The cost of alternative 5 (to supply 81 mgd) is $11,391,000. Assume a bonding period of 25 years. Bonds are sold at 4 percent interest. The annual payment stream over the 25-year bonding period is: $11,391,000 x .06401 = $729,138.

The required Federal investment to provide this annual payment at 3 percent is: $729,138 x 17.41314 = $12,696,000.

Amortize this equivalent Federal investment at 3 percent over the 100-year life of the project to get the average annual cost: $12,696,000 x .03164 = $401,700.

This is the annual benefit if the water were needed at the assumed project completion date (1970). Because the water is not needed until 1980, there is a 10-year lag. The annual benefit must be discounted for 10 years at 3 percent to get the present (1970) value of the water. Before discounting the annual benefit, operation and maintenance cost are added:

($401,700 + $31,000) x .7441 = $321,900

Table IX-1

Alternative Cost Comparison Summary

Alternative[a]	Yield (mgd)	Construction[b] Cost ($1,000's)	Annual[b] Operations & Maintenance ($1,000's)	Annual[c] Transmission Cost ($1,000's)	1970[d] Worth of Annual Benefits ($1,000's)
3. Single-purpose reservoir at the Hackett damsite on James Fork with channel transmission to Fort Smith	51	14,204	14.6	-0-	466
(Plus)					
existing sources on Frogs Bayou	30	-0-	45	73	
4. Single-purpose reservoir at the Pine Mountain damsite on Lee Creek with channel transmission to Fort Smith	51	8,290	29	-0-	324
(Plus)					
existing sources on Frogs Bayou	30	-0-	45	73	
5. Single-purpose reservoir at the Pine Mountain damsite on Lee Creek with channel transmission to Fort Smith	81	11,500	31	-0-	322

[a] Cost for alternates 1 and 2 were not calculated as they were considered infeasible.
[b] All construction cost and operations and maintenance cost supplied by the Corps of Engineers.
[c] Power cost to transfer 30 mgd from the Frogs Bayou Reservoir to Fort Smith.
[d] See page IX-3 for method of calculation.

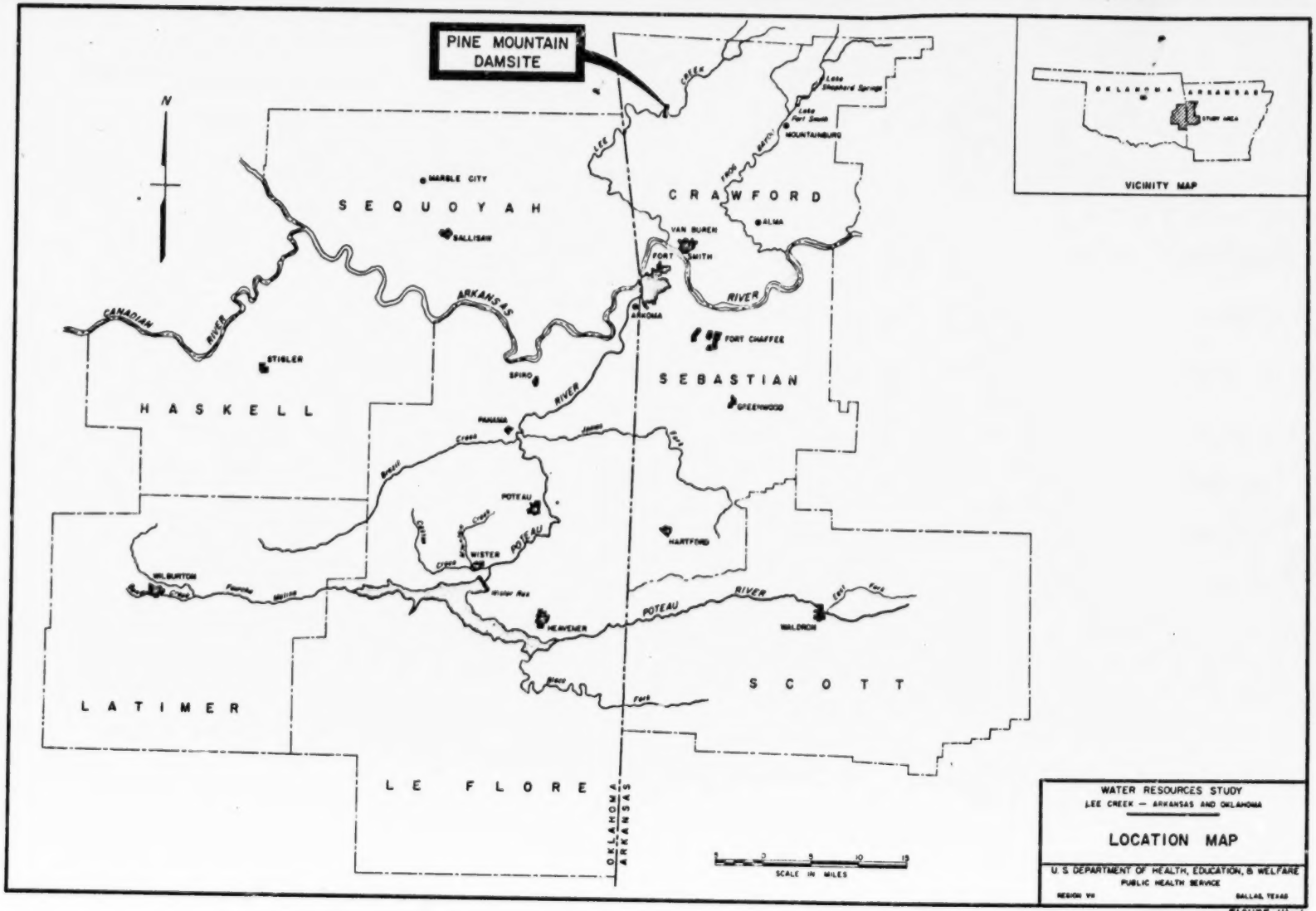

PINE MOUNTAIN DAMSITE
N
SEQUOYAH
CRAWFORD
HASKELL
SEBASTIAN
LATIMER
LE FLORE
SCOTT
MARBLE CITY
SALLISAW
STIGLER
SPIRO
VAN BUREN
FORT SMITH
ALMA
FORT CHAFFEE
GREENWOOD
MOUNTAINBURG
ARKOMA
POTEAU
WISTER
HARTFORD
HEAVENER
WILBURTON
WALDRON
CANADIAN RIVER
ARKANSAS RIVER
POTEAU RIVER
LEE CREEK
OKLAHOMA
ARKANSAS
SCALE IN MILES
VICINITY MAP
OKLAHOMA
ARKANSAS
STUDY AREA
WATER RESOURCES STUDY
LEE CREEK — ARKANSAS AND OKLAHOMA
LOCATION MAP
U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VI
DALLAS, TEXAS

FIGURE III-1

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